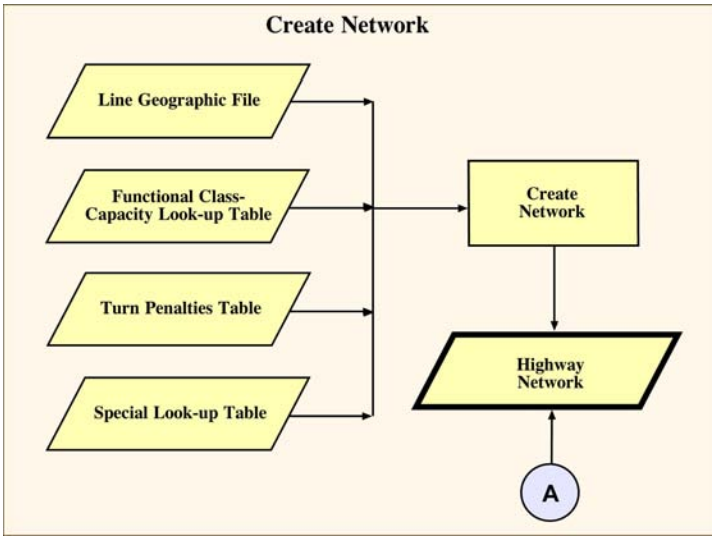
NETWORK (.NET) CREATION

A TransCAD network (.NET) is an abstract representation of the transportation system that holds essential information for analysis in a format required by the TransCAD models. A TransCAD network is defined, derived, and used in conjunction with a geographic line layer and its associated endpoint layer. The network is used for analysis, and the line layer is used to display the results.

Figure 2 shows the process used for creating the TransCAD highway network (.NET).

FIGURE 2. NETWORK CREATION



Line Geographic Database

As mentioned earlier, network creation requires a line geographic file. A line geographic file is a TransCAD GIS database to store the geography and attributes of roadways used in the model. Unlike the "stick" highway networks of previous TP+ model, the geographic file uses shaping between nodes to accurately define both the true geography and true distances of the network links.

Figure 3 displays the base year street network used in the Lincoln MPO model. Table 1 lists all of the database fields in the line geographic file. Some data fields are user populated and some are automatically populated by the Lincoln MPO model interface. Model users should fill the "User populated fields" with valid data to get reasonable model results.

In TransCAD, every line geographic file has an associated node layer file. Table 2 lists the data fields in this node layer. In the node layer table, the first 560 node ID's are designated as

FIGURE 3. BASE YEAR MODEL NETWORK

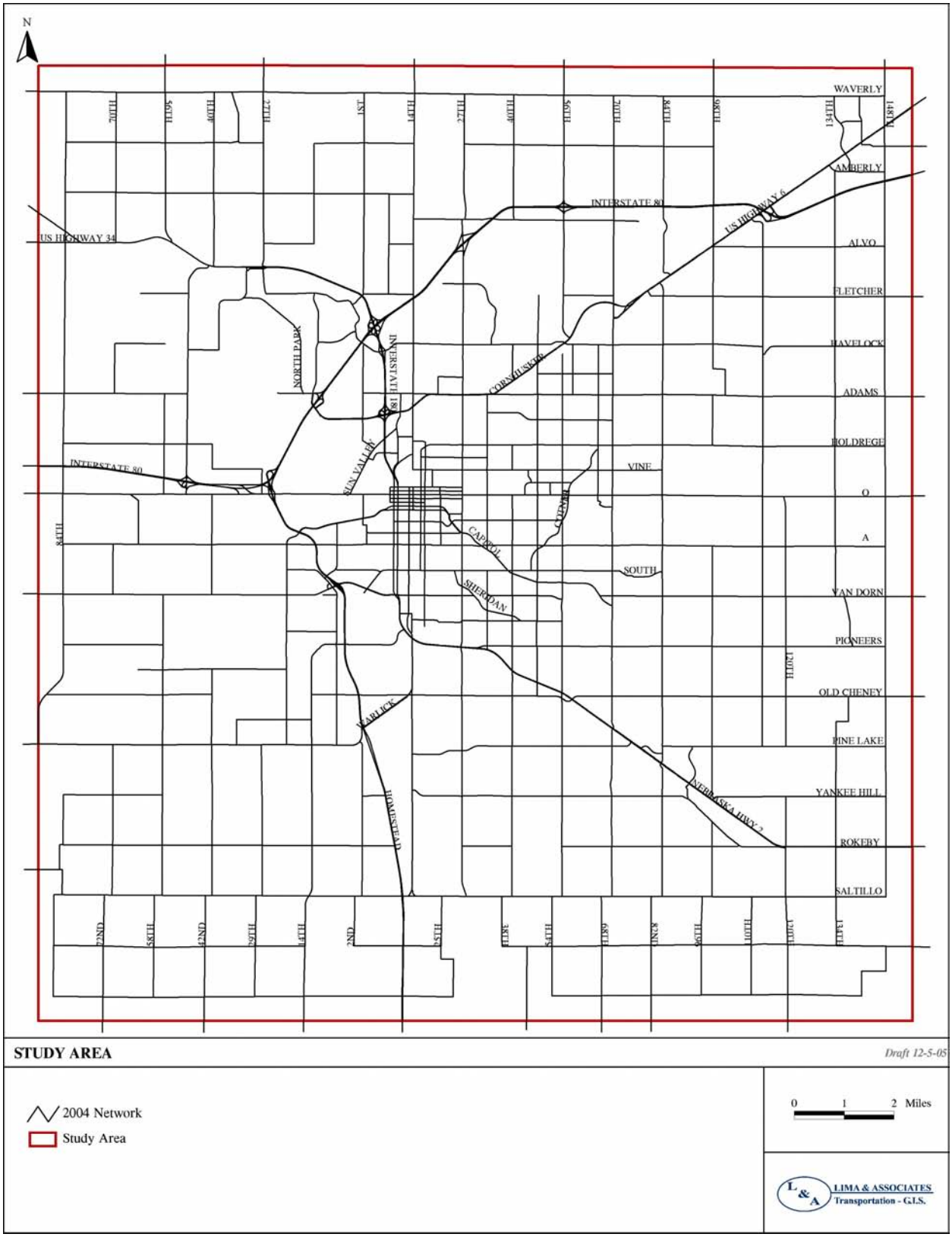


TABLE 1. LINE GEOGRAPHIC FILE DATA FIELDS

	FIELD NAME	DESCRIPTION	TYPE	REQUIRED
Default Fields	ID	Internal ID generated by TransCAD	Integer (4 bytes)	Yes
	Length	Link length determined by TransCAD	Real (8 bytes)	Yes
	Dir	Link direction determined by TransCAD	Integer (2 bytes)	Yes
User Populated Fields	ADJLENGTH	Revised length of link - use if needed	Real (8 bytes)	Yes
	STNAME	Street Name	Character	Optional
	STTYPE	Street Type	Character	Optional
	FUNCLASS	Functional classification code (See Table 4)	Integer (1 byte)	Yes
	FUNCDESC	Functional classification description (See Table 4)	Character	Yes
	AREATYPE	Area type code (See Table 9)	Character	Yes
	AREADESC	Area type description (See Table 9)	Character	Yes
	CountIDcity	Count location ID number	Integer (4 bytes)	Optional
	ABLANES	Number of lanes in AB direction. Eg: ABLANES = NB lanes	Integer (2 bytes)	Yes
	BALANES	Number of lanes in BA direction. Eg: BALANES = SB lanes	Integer (2 bytes)	Yes
	CLANE	Centerlane. 1 = Yes; 0 = No	Integer (2 bytes)	Yes
	TOTLANES	Total number of lanes	Integer (4 bytes)	Optional
	ABMODELSPEED	Link speed used in the model for AB direction	Integer (2 bytes)	Yes
	BAMODELSPEED	Link speed used in the model for BA direction	Integer (2 bytes)	Yes
	ABPOSTEDSPEED	Posted speed limit for AB direction	Integer (4 bytes)	Optional
	BAPOSTEDSPEED	Posted speed limit for BA direction	Integer (4 bytes)	Optional
	ABPARKING	Number of lanes used for parking in AB direction	Integer (2 bytes)	Yes
	BAPARKING	Number of lanes used for parking in BA direction	Integer (2 bytes)	Yes
	UNPAV	1 = Unpaved; 0 = Paved	Integer (2 bytes)	Yes
	TOTCOUNT	Total 24hr count on link	Integer (4 bytes)	Yes
	ABCOUNT	24hr count in AB direction	Integer (4 bytes)	Optional
	BACOUNT	24hr count in BA direction	Integer (4 bytes)	Optional
	SCREENLINE	Screenline number	Integer (1 byte)	Yes
Automatically Populated Fields	AB_CAP_ID	AB capacity ID field (FUNCLASS + "-" + AREATYPE)	Character	Yes
	BA_CAP_ID	BA capacity ID field (FUNCLASS + "-" + AREATYPE)	Character	Yes
	LANECAP	Per lane capacity field (See Table 4)	Integer (4 bytes)	Yes
	ABCAPACITY	Total capacity in AB direction (See Table 4)	Integer (4 bytes)	Yes
	BACAPACITY	Total capacity in BA direction (See Table 4)	Integer (4 bytes)	Yes
	ALPHA	Alpha value	Real (8 bytes)	Yes
	BETA	Beta value	Real (8 bytes)	Yes
	ABTRAVELTIME	Free flow travel time for AB direction	Real (8 bytes)	Yes
	BATRAVELTIME	Free flow travel time for BA direction	Real (8 bytes)	Yes
Model Output Fields	VMT	Total vehicle miles traveled	Real (8 bytes)	Yes
	ABVHT	Vehicle hours traveled in AB direction	Real (8 bytes)	Yes
	BAVHT	Vehicle hours traveled in BA direction	Real (8 bytes)	Yes
	VHT	Total vehicle hours traveled	Real (8 bytes)	Yes
	VOLUME	Model assigned volume	Real (8 bytes)	Yes
	CSPEED	Congested speed on link after traffic assignment	Real (8 bytes)	Yes
	COUNTvVOLUME	Count vs Volume comparison (For use in validation year)	Character	Yes
	VCLOS	VC based LOS	Character	Yes
	SPREDUCTN	Percent reduction in speed after traffic assignment	Real (8 bytes)	Yes
	SPDLOS	LOS based on percent reduction in speed	Character	Yes
	AB_TIME_C_AVG	Congested travel time after traffic assignment in AB direction	Real (8 bytes)	Yes
	BA_TIME_C_AVG	Congested travel time after traffic assignment in BA direction	Real (8 bytes)	Yes

TABLE 2. NODE LAYER DATA FIELDS

	FIELD NAME	DESCRIPTION	TYPE	REQUIRED
Default Fields	ID	Internal ID generated by TransCAD	Integer (4 bytes)	Yes
	Longitude	Longitude value of node generated by TransCAD	Integer (4 bytes)	Yes
	Latitude	Latitude value of node generated by TransCAD	Integer (4 bytes)	Yes
User Fields	TAZ	TAZ number if node is a centroid	Integer (4 bytes)	Yes
	SAVETURNS	Save turn movements at the node. ("yes" = save turns; "no" = don't save turns)	Character	Yes

centroids. There is also a field in the nodes called "TAZ" that contains the taz number for centroids nodes and is missing a value otherwise.

For the Lincoln MPO model, number of lanes and speed data for all roadways was provided by the City of Lincoln, Lancaster County, and Nebraska Department of Roads. Posted speed limits were used as the model network speeds. Figure 4 displays the lane configuration and Figure 5 displays the roadway speed limits for the Lincoln MPO model network.

Functional Class – Capacity Lookup Table

Link capacities for the Lincoln MPO model are based on functional classification and area type. Functional classification data was obtained from the City of Lincoln approved comprehensive plan. Figure 6 displays the functional classification for the model street network. Area type classifications for the model area were provided by the City of Lincoln. Figure 7 shows the area type classification for each roadway in the model network. "Functional Class – Capacity Lookup Table" stores the lane capacity, alpha and beta parameters for each combination of functional classification and area type. This lookup table is linked to the line geographic file table to populate/update capacity fields. In addition, alpha and beta parameters required in the trip assignment step are also populated using this lookup table. Table 3 shows the list of data fields used in the lookup table.

TABLE 3. FUNCTIONAL CLASS – CAPACITY LOOKUP TABLE DATA FIELDS

FIELD NAME	DESCRIPTION	TYPE	REQUIRED
CAP_ID	Capacity ID field (FUNCLASS + "-" + AREATYPE)	Character	Yes
FUNCODE	Functional classification code	Integer (4 bytes)	Yes
FCNAME	Functional classification description	Character	Yes
AREATYPE	Area type code	Integer (4 bytes)	Yes
AREANAME	Area type description	Character	Yes
SPEEDRANGE	Speed range	Character	Optional
CAPACITY	Per lane capacity	Integer (4 bytes)	Yes
ALPHAFC	Alpha value	Real (8 bytes)	Yes
BETAFC	Beta value	Real (8 bytes)	Yes

For the Lincoln MPO model, capacity at Level of Service (LOS) C was used as the threshold capacity. Highway Capacity Manual (HCM) 2000 procedures were used for estimating the capacity for each combination of functional class and area type. First, peak hour lane capacity was calculated after the effects of percent green time, and peak hour factor. Second, the 24 hour lane capacity was calculated using peak hour lane capacity and percent of traffic in the peak hour. Finally, threshold capacity at LOS C was assumed to be 75% of the 24 hour lane capacity. Table 4 shows the calculations used to derive the model capacities.

FIGURE 4. NUMBER OF LANES – 2004 MODEL NETWORK

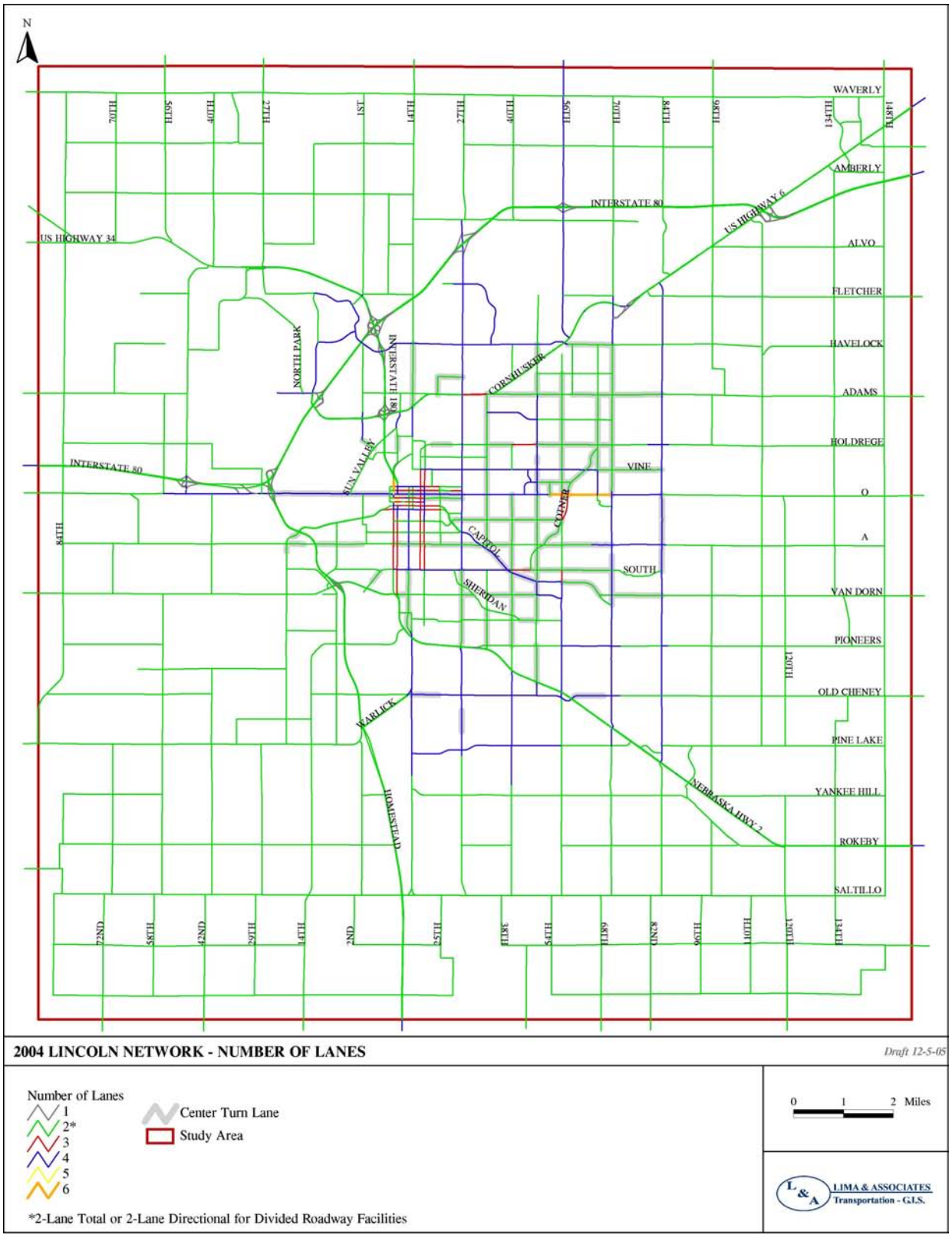


FIGURE 5. SPEED LIMITS – 2004 MODEL NETWORK

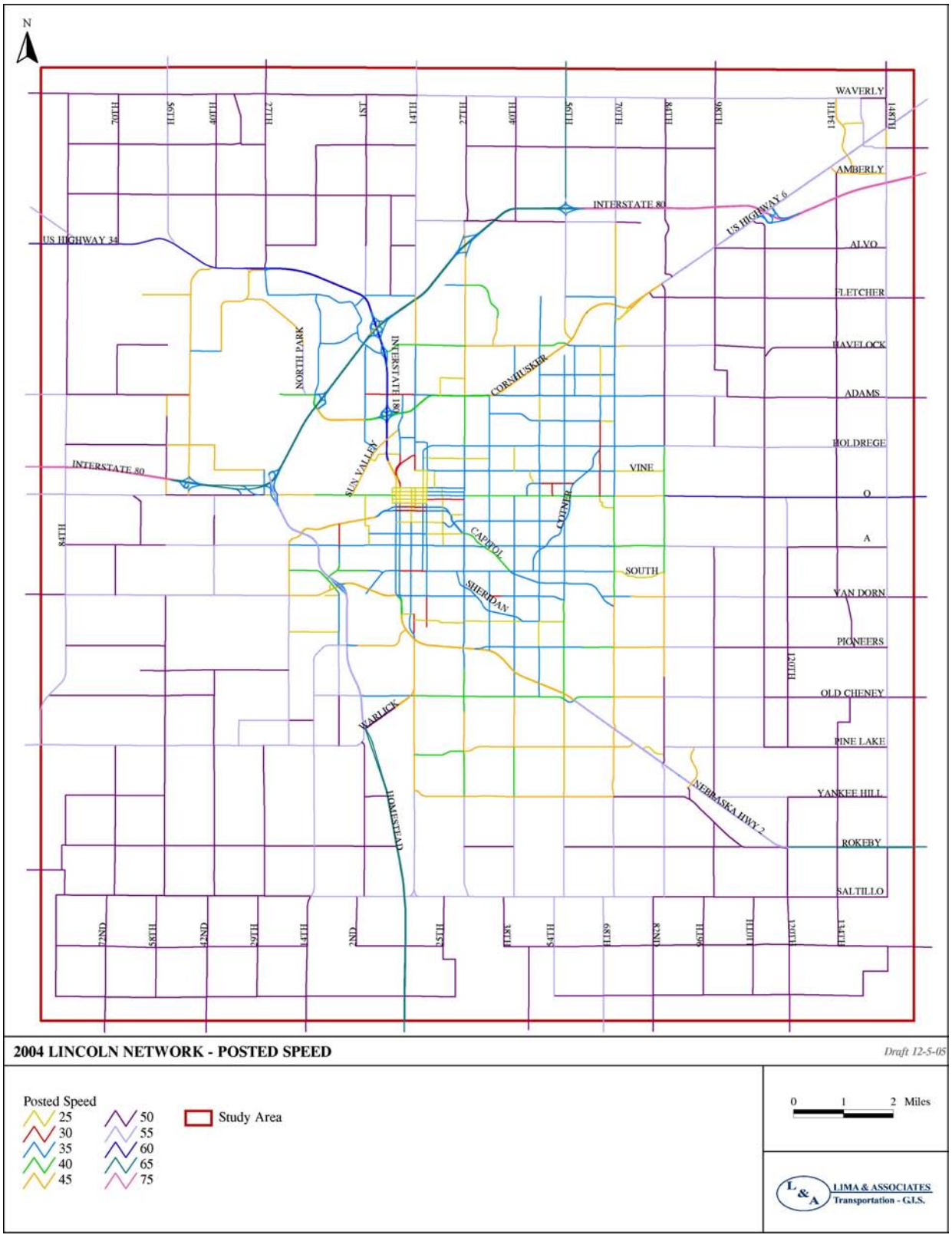


FIGURE 6. FUNCTIONAL CLASSIFICATION – 2004 MODEL NETWORK

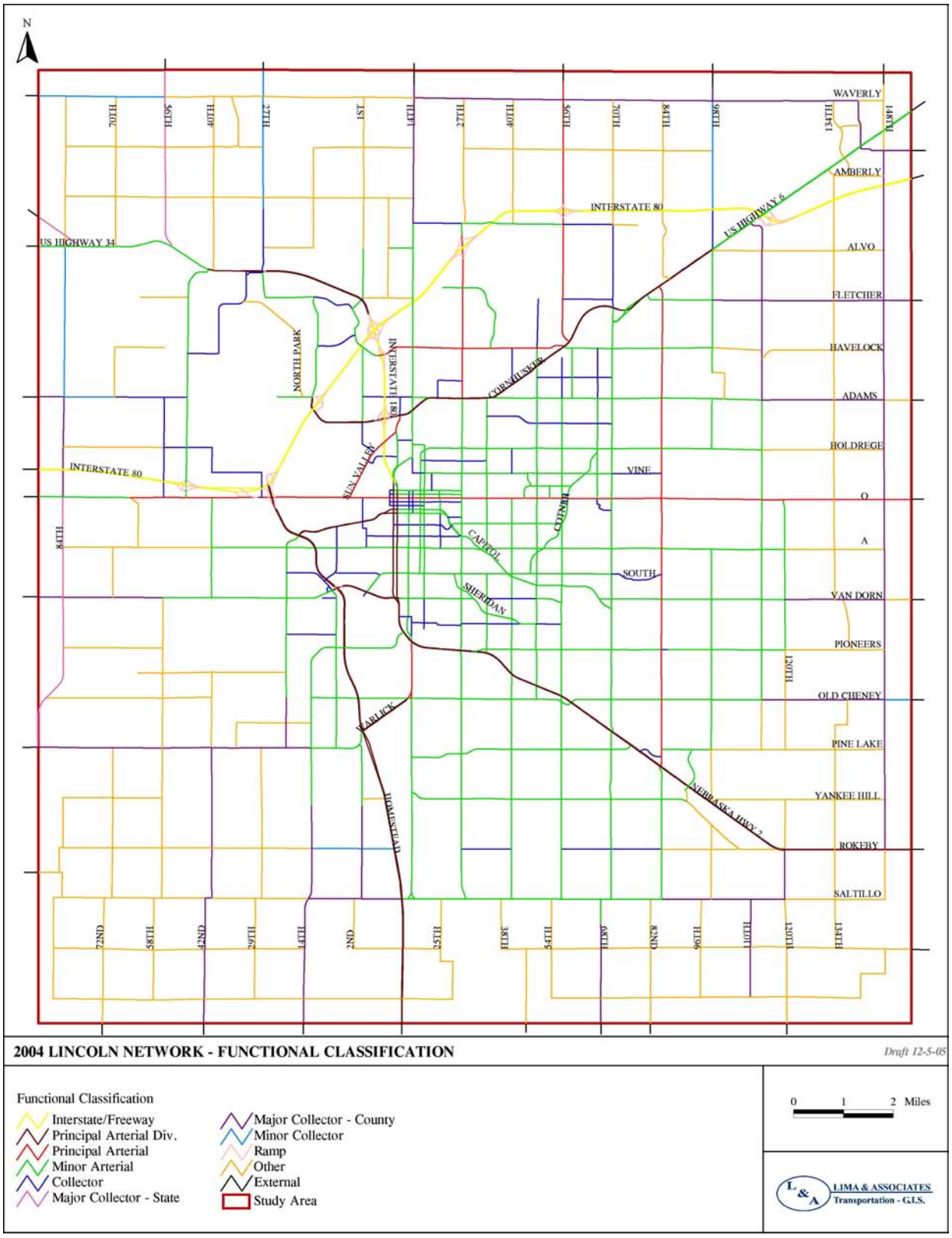


FIGURE 7. AREA TYPE CLASSIFICATION – 2004 MODEL NETWORK

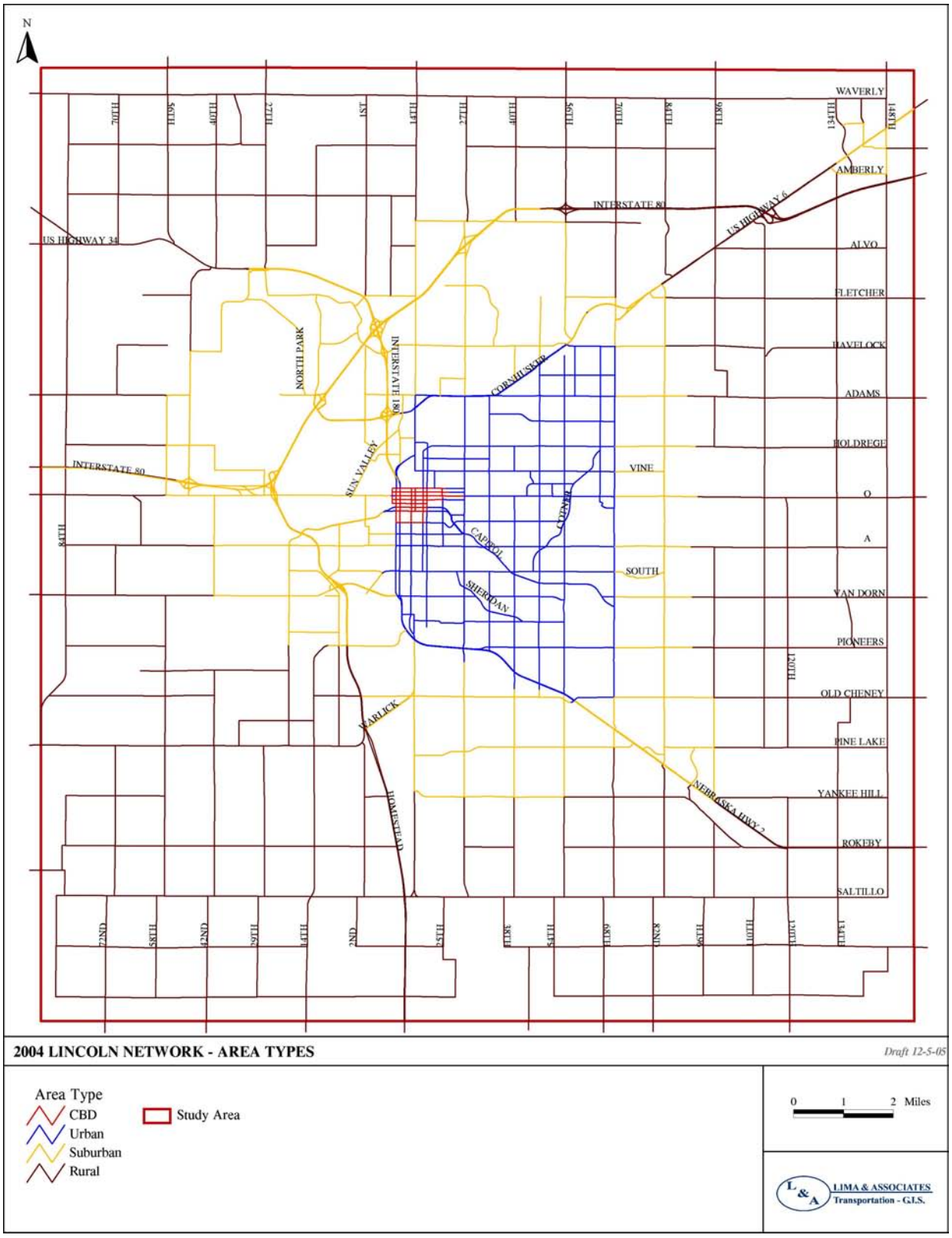


TABLE 4. LANE CAPACITIES USED IN LINCOLN MPO MODEL

Functional Class	FC Code	Area Type Name	Area Type Code	Saturation Lane Capacity	Percent Green Time	Peak Hour Factor	Hourly Lane Capacity	Capacity Added Due to Left Turn Lanes	Total Hourly Lane Capacity (VPH)	Peak-Hour AM & PM Lane Capacity	Percent of Traffic in Peak Hour	Calculated 24-hrs Capacity Max.	24 Hour Approach Lane Capacity (AWDT)	LOS C Percent	24 Hours Lane Capacity LOS C
IH/Freeway	1	CBD	1	2200	100%	0.90	1980	0	1980	1980	0.095	20,842	20,842	75%	15,632
		Urban	2	2200	100%	0.90	1980	0	1980	1980	0.095	20,842	20,842	75%	15,632
		Suburban	3	2200	100%	0.92	2024	0	2024	2024	0.100	20,240	20,240	75%	15,180
		Rural	4	2200	100%	0.92	2024	0	2024	2024	0.110	18,400	18,400	75%	13,800
Expressway	2	CBD	1	2000	60%	0.90	1080	50	1130	1130	0.090	12,556	12,556	75%	9,417
		Urban	2	2000	60%	0.90	1080	50	1130	1130	0.090	12,556	12,556	75%	9,417
		Suburban	3	2000	70%	0.92	1288	50	1338	1338	0.095	14,084	14,084	75%	10,563
		Rural	4	2000	80%	0.95	1520	45	1565	1565	0.110	14,227	14,227	75%	10,670
Principal Arterial (Div)	3	CBD	1	1900	58%	0.90	992	42	1034	1034	0.090	11,487	11,487	75%	8,615
		Urban	2	1900	60%	0.89	1015	42	1057	1057	0.090	11,740	11,740	75%	8,805
		Suburban	3	1900	66%	0.88	1100	42	1142	1142	0.095	12,019	12,019	75%	9,014
		Rural	4	1900	70%	0.90	1197	24	1221	1221	0.110	11,100	11,100	75%	8,325
Principal Arterial	4	CBD	1	1900	53%	0.89	900	38	938	938	0.090	10,425	10,425	75%	7,819
		Urban	2	1900	58%	0.90	987	38	1025	1025	0.095	10,794	10,794	75%	8,095
		Suburban	3	1900	64%	0.88	1066	24	1090	1090	0.095	11,478	11,478	75%	8,609
		Rural	4	1900	68%	0.90	1163	0	1163	1163	0.110	10,571	10,571	75%	7,928
Minor Arterial	5	CBD	1	1900	53%	0.88	886	32	918	918	0.090	10,202	10,202	75%	7,651
		Urban	2	1900	56%	0.88	936	32	968	968	0.095	10,193	10,193	75%	7,645
		Suburban	3	1900	55%	0.86	899	0	899	899	0.100	8,987	8,987	75%	6,740
		Rural	4	1900	55%	0.86	899	0	899	899	0.120	7,489	7,489	75%	5,617
Collector	6	CBD	1	1800	46%	0.86	712	29	741	741	0.095	7,801	7,801	75%	5,851
		Urban	2	1800	37%	0.81	539	0	539	539	0.100	5,395	5,395	75%	4,046
		Suburban	3	1800	37%	0.90	599	0	599	599	0.110	5,449	5,449	75%	4,087
		Rural	4	1800	37%	0.95	633	0	633	633	0.130	4,867	4,867	75%	3,650
Ramp	7	CBD	1	1700	100%	0.83	1411	0	1411	1411	0.090	15,678	15,678	75%	11,758
		Urban	2	1700	100%	0.83	1411	0	1411	1411	0.090	15,678	15,678	75%	11,758
		Suburban	3	1700	100%	0.83	1411	0	1411	1411	0.090	15,678	15,678	75%	11,758
		Rural	4	1700	100%	0.90	1530	0	1530	1530	0.130	11,769	11,769	75%	8,827
Major Collector State	8	Suburban	3	1700	60%	0.85	867	0	867	867	0.100	8,670	8,670	75%	6,503
		Rural	4	1700	60%	0.95	969	0	969	969	0.130	7,454	7,454	75%	5,590
Major Collector County	9	Suburban	3	1700	60%	0.85	867	0	867	867	0.100	8,670	8,670	75%	6,503
		Rural	4	1700	60%	0.95	969	0	969	969	0.130	7,454	7,454	75%	5,590
Minor Collector	10	Rural	4	1700	60%	0.95	969	0	969	969	0.150	6,460	6,460	75%	4,845
Others	11	Rural	4												1,500

Turn Penalties Table

Lincoln MPO model provides the capability of applying penalties or delays when turns are made between certain links in a network. Turn penalties lookup table is used to apply turn penalties or time penalties on links. The table requires that you input the link ID of FROM & TO links and the penalty minutes. If you wish to completely restrict a movement fill the "PENALTY" field with a value of null. Turn penalty table can also used to model delays caused by railroad crossings. Table 5 shows the data structure for the turn penalties table and Appendix A contains the list of turn penalties used in the model.

For the Lincoln MPO model, City of Lincoln staff provided a list of turn penalty movements and locations.

TABLE 5. TURNS PENALTIES

FIELD NAME	DESCRIPTION	TYPE	REQUIRED
FROM_ID	ID of FROM link	Integer (4 bytes)	Required
TO_ID	ID of TO link	Integer (4 bytes)	Required
PENALTY	Penalty value in minutes	Real (8 bytes)	Required

Special Lookup Table

Capacity, alpha, and beta data items are automatically populated using the capacity lookup table. However, there may be some instances when a link's capacity, speed, alpha or beta values need to be changed on a link by link basis. This "Special Lookup Table" can be used for these special situations. The table requires that you input the link ID from the line geographic file along with the data item value (capacity, speed, alpha, or beta) that needs to be changed into the "Special Lookup Table". "Create Network" button in the model interface automatically applies the changes listed in this lookup table. Table 6 shows the data structure of the lookup table.

TABLE 6. SPECIAL LOOKUP TABLE TO MODIFY DEFAULT CAPACITY, SPEED, ALPHA, OR BETA

FIELD NAME	DESCRIPTION	TYPE	REQUIRED
LINKID	Link ID	Integer (4 bytes)	Yes
NLANECAP	New lane capacity	Integer (4 bytes)	Yes
NABMODELSPEED	New AB direction speed	Integer (4 bytes)	Yes
NBAMODELSPEED	New BA direction speed	Integer (4 bytes)	Yes
NALPHA	New alpha value	Real (8 bytes)	Yes
NBETA	New beta value	Real (8 bytes)	Yes

TAZ Geographic Database

The Lincoln MPO model has a total of 560 traffic analysis zones and the TAZ structure is based upon established census tracks. Of these zones, zone numbers 1 to 502 are internal zones and are displayed in Figure 8. Zone numbers 503 to 527 are extra zones for future use and zone numbers 528 to 560 are external zones. TAZ geographic file is a geographic representation of the zone boundaries in GIS. However, this database is not used in the model run. The TAZ geography exists so that users can link model inputs and outputs (e.g. demographics and output trips) to the files and view results geographically. TAZ structure is based on the previous TP+ model. Expansion of the modeling area to the west and south resulted in new TAZs. Existing TAZs were also revised based on recommendations made by the City of Lincoln staff.

Highway Network (.NET)

From the line geographic file, functional class – capacity lookup table, and turn penalties table a TransCAD network (.NET) file is created. The network uses the fields LENGTH, FUNCLASS, *TRAVELTIME, *CAPACITY, ALPHA, and BETA from the line geographic file. Centroids have also been set in this network.

The model interface includes a button that automatically creates the highway network.

FIGURE 8. TRAFFIC ANALYSIS ZONES (TAZ) STRUCTURE